

## Claims

1. Composite material (10) of a substrate (1) with, applied to at least one side,  
 5 a titanium oxide layer (2) with a chemical, physical, mechanical, catalytic  
 and/or optical function,  
  
 characterised in that  
  
 on the substrate (1) is deposited a titanium oxide layer (2) of a base layer  
 10 (3) of  $\text{TiO}_x$  with an oxygen content of  $0.7 \leq x < 2$  or of  $\text{TiO}_x(\text{OH})_y$  with an  
 oxygen content of  $0.5 \leq x < 2$  and a hydroxide content of  $0 \leq y < 0.7$  and on  
 this base layer (3) is applied a top layer (4) of amorphous and/or crystalline  
 $\text{TiO}_2$ .
- 15 2. Composite material (10) according to claim 1, characterised in that the  
 titanium oxide layer (2) has a total layer thickness of 3 to 1000 nm, where  
 the top layer (4) comprises at least around 10% of the total layer (2).
3. Composite material (10) according to claim 2, characterised in that the  
 20 titanium oxide layer (2) has a total layer thickness of 10 to 200 nm,  
 preferably 20 to 150 nm.
4. Composite material (10) according to any of claims 1 to 3, characterised in  
 that between the substrate (1) and the base layer (3) of the titanium oxide  
 25 layer (2) is deposited a protective layer (7) of at least one of the metal  
 oxides of the group comprising ZnO, MgO,  $\text{ZrO}_2$ ,  $\text{In}_2\text{O}_3$ ,  $\text{Sb}_2\text{O}_3$ ,  $\text{Al}_2\text{O}_3$  and  
 $\text{SiO}_2$ , and/or a polar adhesion layer, preferably with maximum the same  
 layer thickness as the titanium oxide layer (2).
- 30 5. Composite material (10) according to any of claims 1 to 4, characterised in  
 that the base layer (3) of  $\text{TiO}_x$  is mixed with at least one metal from the  
 group comprising MgO, ZnO,  $\text{ZrO}_2$ ,  $\text{In}_2\text{O}_3$ ,  $\text{Sb}_2\text{O}_3$ ,  $\text{Al}_2\text{O}_3$  and/or  $\text{SiO}_2$ , and/or  
 is doped with at least one metal oxide of the group comprising  $\text{Fe}_2\text{O}_3$ ,  $\text{WO}_3$ ,

MnO<sub>2</sub>, NiO, BaO and/or CaO, where the total proportion of all metal oxides remains below 50 w.% and the total proportion of the metal oxides of the second group remains below 7 w.%.

- 5    6.    Composite material (10) according to any of claims 1 to 5, characterised in that between the base layer (3) and the top layer (4) of the titanium oxide layer (2) is deposited an electrically conductive intermediate layer (5) which preferably comprises TiO<sub>x</sub> with an oxygen content of  $0.7 \leq x \leq 1.5$ .
- 10   7.    Composite material (10) according to any of claims 1 to 6, characterised in that at least the nine top atomic layers of the top layer (4) of the titanium oxide layer (2) mainly comprise the TiO<sub>2</sub> modification anatase.
- 15   8.    Composite material (10) with a plastic substrate (1) according to any of claims 1 to 7, characterised in that preferably mixed with the plastic substrate (1), finely dispersed, are sub-micron filler particles (6) of a metal oxide or a metal hydroxide which dehydrates under heat.
- 20   9.    Composite material (10) with a flammable substrate according to any of claims 1 to 8, characterised in that the TiO<sub>x</sub> base layer (3) of the titanium oxide layer (2) has an oxygen content of  $1.5 \leq x \leq 1.9$  or the TiO<sub>x</sub>(OH)<sub>y</sub> has a significant hydroxide content of preferably  $0.2 < y < 0.7$ .
- 25   10.    Process for deposition on a substrate (1) of a titanium oxide layer (2) with a chemical, physical, mechanical, catalytic and/or optical function, characterised in that  
  
first reactively or non-reactively a base layer (3) is deposited of TiO<sub>x</sub> with  
30    an oxygen content of  $0.7 \leq x < 2$ , then by increasing the oxygen content, process pressure, power and/or substrate temperature a top layer (4) is deposited of an amorphous or crystalline TiO<sub>2</sub>.

11. Process for deposition on a substrate (1) of a titanium oxide layer (2) with a chemical, physical, mechanical, catalytic and/or optical function,

characterised in that

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in that first reactively or non-reactively a base layer (3) is deposited of  $\text{TiO}_x$  with an oxygen content of  $0.7 \leq x < 2$  and then electrochemically, thermally and/or with a plasma process the surface is post-oxidized until the base layer (3) is restructured at least partly into a top layer (4) of amorphous or crystalline  $\text{TiO}_2$ .

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12. Process according to claim 11, characterised in that a top layer (4) is deposited of  $\text{TiO}_2$  doped with at least one metal oxide, preferably of the group comprising  $\text{Fe}_2\text{O}_3$ ,  $\text{WO}_3$ ,  $\text{MnO}_2$ ,  $\text{NiO}$ ,  $\text{BaO}$  and  $\text{CaO}$ , where in total less than 7 w.% doping is added.

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13. Use of a composite material (10) with a plastic substrate (1) according to any of claims 1 to 12 to increase the thermal stability and flame inhibition of polymer materials in the form of films, membranes, fibres, powders, textiles, fabrics, tubes and containers.

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14. Use of a composite material (10) according to any of claims 1 to 12 as active hygiene protection for the preparation of drinking water, watery solutions and air, for textiles, curtains, carpets, films, membranes, cables, packing, glassware, windows, composite materials, elements in medical technology, photovoltaics and optical systems, gas sensors and electronic circuits.

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